Refine Search

Search Results -

Terms	Documents
L1 and (backplane or (back adj1 plane))	3

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L5

Refine Search

Recall Text | Clear | Interrupt

Search History

DATE: Monday, August 23, 2004 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT,USOC; PLUR=YES; OP=OR			
L5	L1 and (backplane or (back adj1 plane))	3	L5
L4	L1 and ((backplane or (back adj1 plane)) same bus)	1	L4
L3	L2	1	L3
L2	L1 and (backplane near3 bus)	1	L2
L1	(switch$3 near3 path) same (enabl$3 or disabl$3) same controller same (memory or storage)	60	L1

END OF SEARCH HISTORY

h e b b cg b e e ch

Refine Search

Search Results -

Terms	Documents
L1 and (backplane or (back adj1 plane))	3

Database:
US Pre-Grant Publication Full-Text Database
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Search: L5

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Search History

DATE: Monday, August 23, 2004 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT,USOC; PLUR=YES; OP=OR			
L5	L1 and (backplane or (back adj1 plane))	3	L5
L4	L1 and ((backplane or (back adj1 plane)) same bus)	1	L4
L3	L2	1	L3
L2	L1 and (backplane near3 bus)	1	L2
L1	(switch$3 near3 path) same (enabl$3 or disabl$3) same controller same (memory or storage)	60	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
(702/184 |702/185 |370/381 |370/351 |370/362 |370/431 |370/388 |370/401 |370/402 |709/213 |709/229 |709/253 |710/305 |710/307 |710/316 |710/300 |710/317 |710/22 |710/306 |710/313 |307/112 |307/115 |711/100 |711/112 |711/18 |711/141 |379/272 |379/291 |340/825 |712/28 |712/29 |714/5 |714/6 |714/7 |714/25).ccls.	16111

Database:
- US Pre-Grant Publication Full-Text Database
- US Patents Full-Text Database
- US OCR Full-Text Database
- EPO Abstracts Database
- JPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins

Search: L6

Refine Search | Recall Text | Clear | Interrupt

Search History

DATE: Monday, August 23, 2004 Printable Copy Create Case

Set Name	Query
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	DB=USPT,USOC; PLUR=YES; OP=OR
L6	710/305,307,316,300,317,22,306,313;709/213,229,253;714/5-7,25;370/381,351,362,431,388,401,402;702/184,185;711/100,112,18,141;712/28,29;307/112,115
L5	L1 and (backplane or (back adj1 plane))
L4	L1 and ((backplane or (back adj1 plane)) same bus)
L3	L2
L2	L1 and (backplane near3 bus)
L1	(switch$3 near3 path) same (enabl$3 or disabl$3) same controller same (memory or storage)

END OF SEARCH HISTORY

h e b b cg b e e ch

Refine Search

Search Results -

Terms	Documents
L1 and L6	21

Database:
- US Pre-Grant Publication Full-Text Database
- US Patents Full-Text Database
- US OCR Full-Text Database
- EPO Abstracts Database
- JPO Abstracts Database
- Derwent World Patents Index
- IBM Technical Disclosure Bulletins

Search: L7

Refine Search

Recall Text | Clear | Interrupt

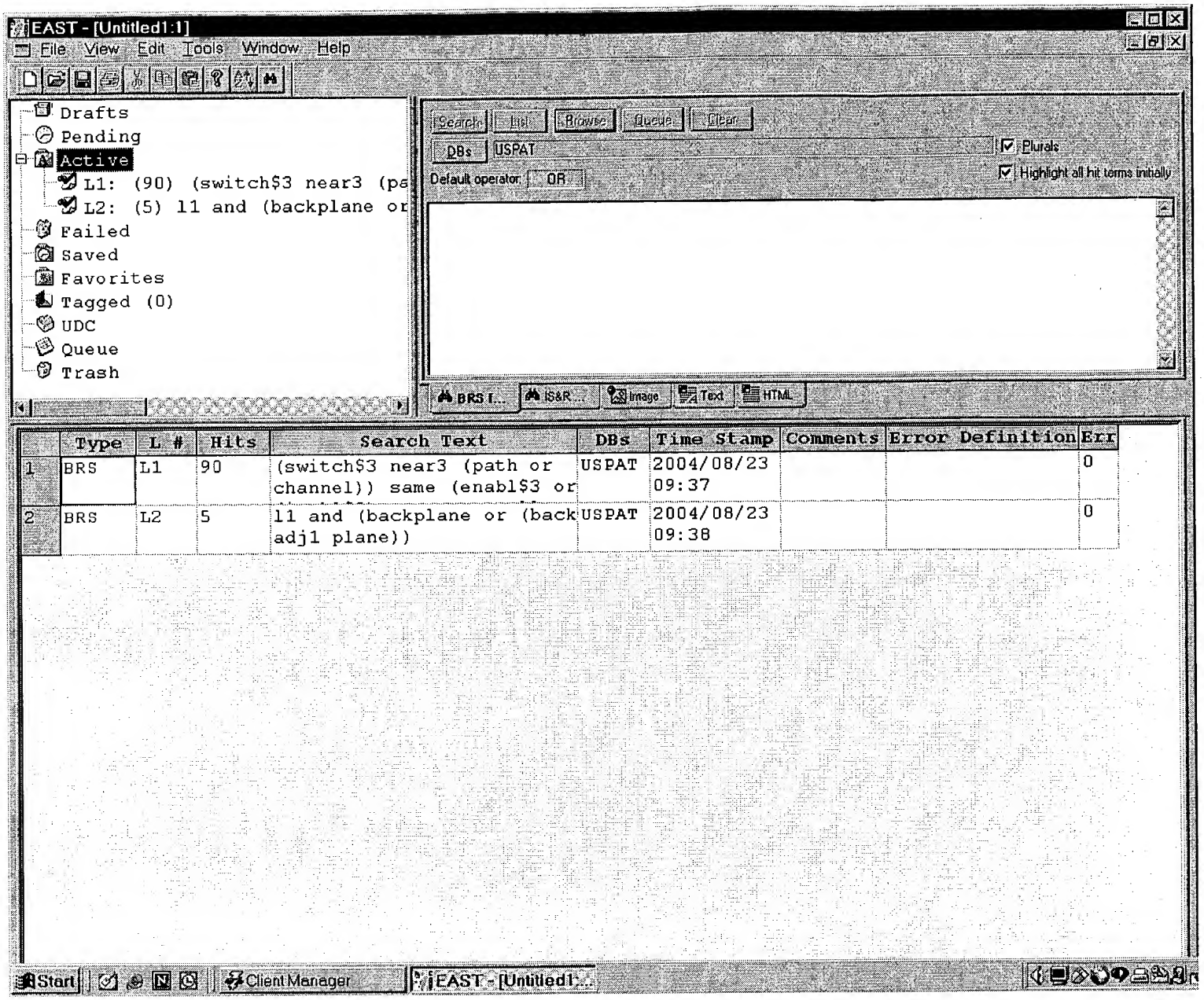
Search History

DATE: Monday, August 23, 2004 Printable Copy Create Case

Set Name side by side	Query
	DB=USPT,USOC; PLUR=YES; OP=OR
L7	l1 and L6
L6	710/305,307,316,300,317,22,306,313;709/213,229,253;714/5-7,25;370/381,351,362,431,388,401,402;702/184,185;711/100,112,18,141;712/28,29;307/112,115
L5	L1 and (backplane or (back adj1 plane))
L4	L1 and ((backplane or (back adj1 plane)) same bus)
L3	L2
L2	L1 and (backplane near3 bus)
L1	(switch$3 near3 path) same (enabl$3 or disabl$3) same controller same (memory or storage)

END OF SEARCH HISTORY

h e b b cg b e e ch



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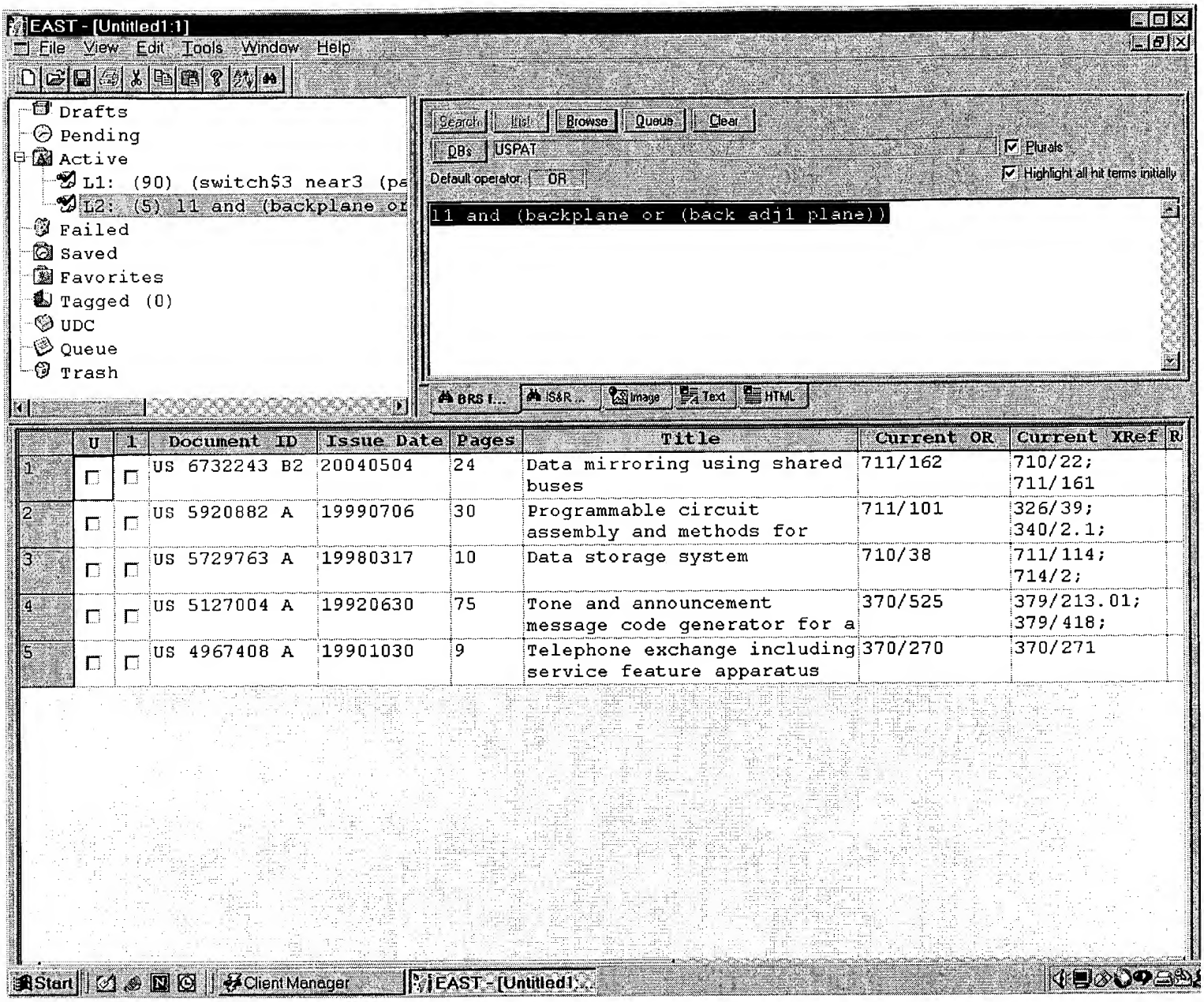
1	BRS	L1	90	(switch$3 near3 (path or channel)) same (enabl$3 or	USPAT	2004/08/23 09:37			0
2	BRS	L2	5	l1 and (backplane or (back adj1 plane))	USPAT	2004/08/23 09:38			0


EAST - [Untitled1:1]
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L2: (5) l1 and (backplane or
Failed
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OR
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Document ID
Issue Date
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Title
Current OR
Current XRef
1 US 6732243 B2 20040504 24 Data mirroring using shared buses 711/162 710/22; 711/161
2 US 5920882 A 19990706 30 Programmable circuit assembly and methods for 711/101 326/39; 340/2.1;
3 US 5729763 A 19980317 10 Data storage system 710/38 711/114; 714/2;
4 US 5127004 A 19920630 75 Tone and announcement message code generator for a 370/525 379/213.01; 379/418;
5 US 4967408 A 19901030 9 Telephone exchange including service feature apparatus 370/270 370/271
Start
Client Manager
EAST - [Untitled1:...

Your search matched **8** of **1062489** documents.
A maximum of **500** results are displayed, **15** to a page, sorted by **Relevance Descending** order.

Refine This Search:
You may refine your search by editing the current search expression or enteri new one in the text box.

switch* and (path or channel)<and>(enabl* or disabl Search

☐ Check to search within this result set

Results Key:
JNL = Journal or Magazine **CNF** = Conference **STD** = Standard

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1 **Reservation arbitrated access for statistical multiplexing voice traff over dual-bus metropolitan area networks**
Chan, H.C.B.; Leung, V.C.M.;
Selected Areas in Communications, IEEE Journal on , Volume: 17 , Issue: 1 , 1999
Pages:42 - 50

[Abstract] [PDF Full-Text (248 KB)] **IEEE JNL**

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2 **Structured architectures for video distribution with externally modu solid state laser transmitters**
Nazarathy, M.; Berger, J.; Ley, A.J.; Levi, I.M.; Kagan, Y.; Middleton, L.;
Communications, 1993. ICC 93. Geneva. Technical Program, Conference Rec IEEE International Conference on , Volume: 3 , 23-26 May 1993
Pages:1580 - 1582 vol.3

[Abstract] [PDF Full-Text (272 KB)] **IEEE CNF**

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3 **Design of a multigigabit optical network interface card**
Chandramani, P.; Ping Gui; Ekman, J.; Xiaoqing Wang; Kiamilev, F.; Christen M.; Milojkovic, P.; Haney, M.W.; Anderson, J.; Driscoll, K.; Vanvoorst, B.;
Selected Topics in Quantum Electronics, IEEE Journal of , Volume: 9 , Issue: 2 , March-April 2003
Pages:636 - 646

[Abstract] [PDF Full-Text (2450 KB)] **IEEE JNL**

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4 **DVB specifications for broadcast-related interactive TV services**
Mills, G.S.; Dobbie, W.H.; Bensberg, G.;
Electronics & Communication Engineering Journal , Volume: 9 , Issue: 1 , Fet

1997
Pages:38 - 42

[Abstract] [PDF Full-Text (608 KB)] **IEE JNL**

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5 **@INGate: a distributed intelligent network approach to bridge swit and packet networks**
Simeonov, P.L.; Hofmann, P.; Rebenburg, M.; Ruffer, D.;
Computer Communications and Networks, 1997. Proceedings., Sixth Internat Conference on , 22-25 Sept. 1997
Pages:358 - 363

[Abstract] [PDF Full-Text (596 KB)] **IEEE CNF**

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6 **A transition-encoded dynamic bus technique for high-performance interconnects**
Anders, M.; Rai, N.; Krishnamurthy, R.K.; Borkar, S.;
Solid-State Circuits, IEEE Journal of , Volume: 38 , Issue: 5 , May 2003
Pages:709 - 714

[Abstract] [PDF Full-Text (450 KB)] **IEEE JNL**

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7 **A 600V quick punch through (QPT) IGBT design concept for reducin EMI**
Yedinak, J.; Gladish, J.; Brockway, B.; Shekhawat, S.; Shenoy, P.; Lange, D., Dolny, G.; Rinehimer, M.;
Power Semiconductor Devices and ICs, 2003. Proceedings. ISPSD '03. 2003 I 15th International Symposium on , 14-17 April 2003
Pages:67 - 70

[Abstract] [PDF Full-Text (335 KB)] **IEEE CNF**

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8 **Wafer-scale integration defect avoidance tradeoffs between laser li and Omega network switching**
Chapman, G.H.; Bergen, D.E.; Fang, K.;
Defect and Fault Tolerance in VLSI Systems, 1995. Proceedings., 1995 IEEE International Workshop on, , 13-15 Nov. 1995
Pages:37 - 45

[Abstract] [PDF Full-Text (584 KB)] **IEEE CNF**

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Your search matched **0** of **1062489** documents.
A maximum of **500** results are displayed, **15** to a page, sorted by **Relevance Descending** order.

Refine This Search:
You may refine your search by editing the current search expression or enter new one in the text box.

switch* and (path or channel)<and>(enabl* or disabl Search

☐ Check to search within this result set

Results Key:
JNL = Journal or Magazine **CNF** = Conference **STD** = Standard

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Results:
No documents matched your query.

Hit List

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 10 of 21 returned.

☐ 1. Document ID: US 6735637 B2

Using default format because multiple data bases are involved.

L7: Entry 1 of 21 File: USPT May 11, 2004

US-PAT-NO: 6735637
DOCUMENT-IDENTIFIER: US 6735637 B2

TITLE: Method and system for providing advanced warning to a data stage device in order to decrease the time for a mirror split operation without starving host I/O request processsing

DATE-ISSUED: May 11, 2004

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Cochran; Robert A.	Rocklin	CA		

US-CL-CURRENT: 710/5; 710/19, 710/52, 711/112, 712/225

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 2. Document ID: US 6732243 B2

L7: Entry 2 of 21 File: USPT May 4, 2004

US-PAT-NO: 6732243
DOCUMENT-IDENTIFIER: US 6732243 B2

TITLE: Data mirroring using shared buses

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 3. Document ID: US 6721902 B1

L7: Entry 3 of 21 File: USPT Apr 13, 2004

US-PAT-NO: 6721902
DOCUMENT-IDENTIFIER: US 6721902 B1

TITLE: Method and system for providing LUN-based backup reliability via LUN-based locking

h e b b g e e e f e h b ef b e

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

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☐ 4. Document ID: US 6718447 B2

L7: Entry 4 of 21 File: USPT Apr 6, 2004

US-PAT-NO: 6718447
DOCUMENT-IDENTIFIER: US 6718447 B2

TITLE: Method and system for providing logically consistent logical unit backup snapshots within one or more data storage devices

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

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☐ 5. Document ID: US 6697881 B2

L7: Entry 5 of 21 File: USPT Feb 24, 2004

US-PAT-NO: 6697881
DOCUMENT-IDENTIFIER: US 6697881 B2

TITLE: Method and system for efficient format, read, write, and initial copy processing involving sparse logical units

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

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☐ 6. Document ID: US 6594745 B2

L7: Entry 6 of 21 File: USPT Jul 15, 2003

US-PAT-NO: 6594745
DOCUMENT-IDENTIFIER: US 6594745 B2

TITLE: Mirroring agent accessible to remote host computers, and accessing remote data-storage devices, via a communcations medium

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

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☐ 7. Document ID: US 6507581 B1

L7: Entry 7 of 21 File: USPT Jan 14, 2003

US-PAT-NO: 6507581
DOCUMENT-IDENTIFIER: US 6507581 B1

TITLE: Dynamic port mode selection for crosspoint switch

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

h e b b g e e e f e h b ef b e

☐ 8. Document ID: US 6457087 B1

L7: Entry 8 of 21 File: USPT Sep 24, 2002

US-PAT-NO: 6457087
DOCUMENT-IDENTIFIER: US 6457087 B1

TITLE: Apparatus and method for a cache coherent shared memory multiprocessing system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 9. Document ID: US 6334164 B1

L7: Entry 9 of 21 File: USPT Dec 25, 2001

US-PAT-NO: 6334164
DOCUMENT-IDENTIFIER: US 6334164 B1

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 10. Document ID: US 6195719 B1

L7: Entry 10 of 21 File: USPT Feb 27, 2001

US-PAT-NO: 6195719
DOCUMENT-IDENTIFIER: US 6195719 B1

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L1 and L6	21

Display Format: - Change Format

Previous Page Next Page Go to Doc#

Hit List

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 11 through 20 of 21 returned.

☐ 11. Document ID: US 6098136 A

Using default format because multiple data bases are involved.

L7: Entry 11 of 21 File: USPT Aug 1, 2000

US-PAT-NO: 6098136
DOCUMENT-IDENTIFIER: US 6098136 A

TITLE: Multiple bus system using a data transfer unit

DATE-ISSUED: August 1, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Okazawa; Koichi	Tokyo			JP
Kimura; Koichi	Yokohama			JP
Kawaguchi; Hitoshi	Yokohama			JP
Aburano; Ichiharu	Hitachi			JP
Kobayashi; Kazushi	Ebina			JP
Mochida; Tetsuya	Yokohama			JP

US-CL-CURRENT: 710/306

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 12. Document ID: US 6006302 A

L7: Entry 12 of 21 File: USPT Dec 21, 1999

US-PAT-NO: 6006302
DOCUMENT-IDENTIFIER: US 6006302 A
** See image for Certificate of Correction **

TITLE: Multiple bus system using a data transfer unit

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 13. Document ID: US 5935231 A

L7: Entry 13 of 21 File: USPT Aug 10, 1999

h e b b cg b cc e

US-PAT-NO: 5935231
DOCUMENT-IDENTIFIER: US 5935231 A

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | ... | Claims | KWMC | Draw De

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☐ 14. Document ID: US 5889971 A

L7: Entry 14 of 21 File: USPT Mar 30, 1999

US-PAT-NO: 5889971
DOCUMENT-IDENTIFIER: US 5889971 A

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | ... | Claims | KWMC | Draw De

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☐ 15. Document ID: US 5751976 A

L7: Entry 15 of 21 File: USPT May 12, 1998

US-PAT-NO: 5751976
DOCUMENT-IDENTIFIER: US 5751976 A

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | ... | Claims | KWMC | Draw De

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☐ 16. Document ID: US 5737755 A

L7: Entry 16 of 21 File: USPT Apr 7, 1998

US-PAT-NO: 5737755
DOCUMENT-IDENTIFIER: US 5737755 A
**** See image for Certificate of Correction ****

TITLE: System level mechanism for invalidating data stored in the external cache of a processor in a computer system

Full | Title | Citation | Front | Review | Classification | Date | Reference | ... | Claims | KWMC | Draw De

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☐ 17. Document ID: US 5668956 A

L7: Entry 17 of 21 File: USPT Sep 16, 1997

US-PAT-NO: 5668956
DOCUMENT-IDENTIFIER: US 5668956 A
**** See image for Certificate of Correction ****

h e b b cg b cc e

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw. De

☐ 18. Document ID: US 5506973 A

L7: Entry 18 of 21 File: USPT Apr 9, 1996

US-PAT-NO: 5506973
DOCUMENT-IDENTIFIER: US 5506973 A
** See image for Certificate of Correction **

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw. De

☐ 19. Document ID: US 5483642 A

L7: Entry 19 of 21 File: USPT Jan 9, 1996

US-PAT-NO: 5483642
DOCUMENT-IDENTIFIER: US 5483642 A
** See image for Certificate of Correction **

TITLE: Bus system for use with information processing apparatus

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw. De

☐ 20. Document ID: US 5289589 A

L7: Entry 20 of 21 File: USPT Feb 22, 1994

US-PAT-NO: 5289589
DOCUMENT-IDENTIFIER: US 5289589 A
** See image for Certificate of Correction **

TITLE: Automated storage library having redundant SCSI bus system

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw. De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
L1 and L6	21

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Display Format: - Change Format

Previous Page Next Page Go to Doc#

US006732243B2

(12) **United States Patent**
Busser et al.

(10) **Patent No.: US 6,732,243 B2**
(45) **Date of Patent: May 4, 2004**

(54) **DATA MIRRORING USING SHARED BUSES**

(75) Inventors: **Richard W. Busser**, Longmont, CO (US); **Ian R. Davies**, Longmont, CO (US)

(73) Assignee: **Chaparral Network Storage, Inc.**, Longmont, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 114 days.

(21) Appl. No.: 10/036,749

(22) Filed: Nov. 8, 2001

(65) **Prior Publication Data**

US 2003/0088735 A1 May 8, 2003

(51) Int. Cl.[7] G06F 12/08
(52) U.S. Cl. 711/162; 711/161; 710/22
(58) Field of Search 711/161, 152; 710/22–28

(56) **References Cited**

U.S. PATENT DOCUMENTS

2001/0013076 A1 * 8/2001 Yamamoto 710/33
2002/0099881 A1 * 7/2002 Gugel 710/26

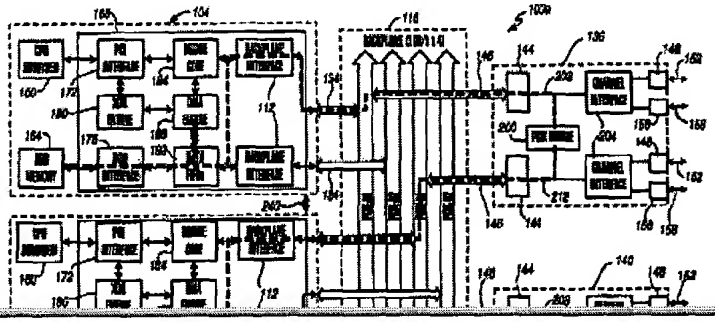
* cited by examiner

Primary Examiner—Mano Padmanabhan
Assistant Examiner—Midya Iroa
(74) *Attorney, Agent, or Firm*—Sheridan Ross P.C.

(57) **ABSTRACT**

A network storage controller for transferring data between a host computer and a storage device, such as a redundant array of inexpensive disks (RAID), is disclosed. The network storage controller includes at least one channel interface module which is adapted to be connected to the host computer and storage device. The channel interface module is connected to a passive backplane, and selectively transfers data between the host computer and storage device and the passive backplane. The network storage controller also includes at least one controller management module, attached to the passive backplane. The controller management module communicates with the channel interface module via the passive backplane, and processes and temporarily stores data received from the host computer or storage device. In applications where redundancy is required, at least two controller management modules and at least two channel interface modules may be used. The controller management modules may mirror data between one another using the passive backplane and a shared communication path on the channel interface modules, thereby substantially avoiding the use of host or disk channels to mirror data. The channel interface modules are operable to connect the host computer or storage device to one or more controller memory modules. The controller memory modules may include a DMA engine to facilitate the transfer of mirrored data.

27 Claims, 13 Drawing Sheets



US-PAT-NO: 6732243

DOCUMENT-IDENTIFIER: US 6732243 B2

TITLE: Data mirroring using shared buses

---------- KWIC ---------

Abstract Text - ABTX (1):

A network storage controller for transferring data between a host computer and a storage device, such as a redundant array of inexpensive disks (RAID), is disclosed. The network storage controller includes at least one channel interface module which is adapted to be connected to the host computer and storage device. The channel interface module is connected to a passive backplane, and selectively transfers data between the host computer and storage device and the passive backplane. The network storage controller also includes at least one controller management module, attached to the passive backplane. The controller management module communicates with the channel interface module via the passive backplane, and processes and temporarily stores data received from the host computer or storage device. In applications where redundancy is required, at least two controller management modules and at least two channel interface modules may be used. The controller management modules may mirror data between one another using the passive backplane and a shared communication path on the channel interface modules, thereby substantially avoiding the use of host or disk channels to mirror data. The channel interface modules are operable to connect the host computer or storage device to one or more controller memory modules. The controller memory modules may include a DMA engine to facilitate the transfer of mirrored data.

Brief Summary Text - BSTX (8):

The controllers 30, 34 are connected to a fibre channel bus 38, which is connected to two IO modules, IO module-142, and IO module-246. Each controller 30, 34, includes a CPU subsystem 50, a double data rate (DDR) memory 54, control logic 58, a dual port fibre channel connection with two host ports 62a, 62b and a dual port fibre channel connection with two disk ports 66a, 66b. The CPU subsystem 58 performs tasks required for storage of data onto an array of disks, including striping data, and initiating and executing read and write commands. The DDR memory 54 is a nonvolatile storage area for data and other

elaborate, complex, fan-out wiring arrangement has been suggested for the backplane. Further, the slots provided for the two LRC boards eliminates two disk drives, and the disk interfaces which would otherwise be plugged into these two slots of the backplane.

Brief Summary Text - BSTX (10):

In accordance with the present invention, a data storage system is provided wherein each one of a plurality of disk interfaces is coupled to a corresponding storage disk drive. A first portion of the disk interfaces is coupled to a first disk controller through a first unidirectional channel and a second portion of the disk interfaces is coupled to a second disk controller through a second unidirectional channel. Each disk interface in the first portion includes a switch adapted to allow address control and data (hereinafter referred to, collectively, as data) to pass though the first channel; and, when the second channel becomes inoperative, couple an operative disk drives in the inoperative second channel to the first channel. With such arrangement, redundancy is provided because if the second disk controller becomes inoperative, the first disk controller is able to store data in and/or retrieve data from the disk drives in the second channel. Further, if one of the disk drives in the second channel is inoperative, all of the other, operative disk drives in the second channel are switched to the first channel, thereby enabling the disk drive to be replaced without having to shut down the operative disk drives in the second channel, i.e., the inoperative disk drive may be "hot swapped".

Brief Summary Text - BSTX (11):

In accordance with another feature of the invention, the switch is disposed on a common printed circuit board with the disk interface. Thus, the interface and its disk drive are packaged as a module to facilitate maintenance and providing system modularity. With such arrangement a simpler, local (i.e, the disk interface and the switch are located on a common printed circuit board) connecting arrangement is used to interconnect the disk drives and their associated switches as compared with the complex, fan-out connection arrangement discussed above. Still further, with this arrangement, there is no loss of slots on the backplane.

Detailed Description Text - DETX (2):

Referring now to FIG. 1, a computer system 10 is shown. The computer system 10 includes a main frame computer section 12 for processing data. Portions of the processed data are stored in, and retrieved data from, a bank 16 of

US005729763A

United States Patent [19]

Leshem

[11] Patent Number: 5,729,763

[45] Date of Patent: Mar. 17, 1998

[54] DATA STORAGE SYSTEM

[75] Inventor: Eli Leshem, Brookline, Mass.

[73] Assignee: EMC Corporation, Hopkinton, Mass.

[21] Appl. No.: 515,343

[22] Filed: Aug. 15, 1995

[51] Int. Cl.[6] G06F 11/20

[52] U.S. Cl. 395/858; 395/441; 395/181; 395/182.05

[58] Field of Search 395/858, 180, 395/181, 182, 441; 371/10

[56] References Cited

U.S. PATENT DOCUMENTS

5,077,736	12/1991	Dunphy, Jr. et al.	371/10.1
5,119,488	6/1992	Takemasa et al.	395/182.02
5,269,011	12/1993	Yanai et al.	395/425
5,363,502	11/1994	Kagimasa	395/575
5,371,882	12/1994	Ludlam	395/182.05
5,479,653	12/1995	Jones	395/182.03
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[57] ABSTRACT

A data storage system is provided wherein each one of a plurality of disk interfaces is coupled to a corresponding storage disk drive. The disk interfaces in one portion are coupled through a first unidirectional channel to a first disk controller and the disk interfaces in another portion of the disk interfaces are coupled through a second unidirectional channel to a second disk controller. Each disk interface includes a switch adapted to allow data to pass to another disk drive in the channel thereof; and, when the other channel becomes inoperative, coupling the disk drive in the inoperative channel to the operative fiber channel. With such arrangement, a disk drive may be removed without requiring a shut-down of the storage system (i.e., the disk drive may be "hot swapped"). In one embodiment, a pair of the switches is disposed on the common printed circuit board with the disk interface for enabling depopulation, or removal of, disk drives from the storage system.

6 Claims, 5 Drawing Sheets